

What is claimed is:

1. A catheter for ablation and/or mapping of the heart wall comprising:
 - an elongated catheter body having proximal and distal ends and a catheter body axis, the catheter body further comprising a catheter body proximal section joined at a proximal section distal end with a deflectable catheter body distal section;
 - said distal section including a curvable proximal segment, a distal segment and a bendable intermediate segment having a predetermined intermediate segment length joined at an intermediate segment proximal end with a curvable proximal segment distal end and joined at an intermediate segment distal end with the distal segment, the intermediate segment capable of bending in a knuckle bend having a radius in the range of about 2.0 mm through 7.0 mm through a bend angle range of about -90° to about $+180^{\circ}$ with respect to the catheter body axis at the intermediate segment proximal end;
 - at least one electrode positioned along the distal segment;
 - a handle at the proximal end of the catheter body;
 - a conductor extending along the catheter body between said electrode and the handle;
 - a knuckle bend wire coupled to the distal segment and extending proximally through the bendable intermediate segment, the curvable proximal segment, and the proximal section of the catheter body to a knuckle bend wire proximal end in the handle;
 - a knuckle bend manipulator coupled to the knuckle bend wire proximal end and mounted for movement to the handle enabling selective extension and retraction of the knuckle bend wire to induce a bend in the bendable intermediate segment;
 - a curve deflection wire coupled to the distal end of the proximal segment and extending proximally through the curvable proximal segment and the proximal section of the catheter body to a curve deflection wire proximal end in the handle; and

a proximal curve manipulator coupled to the curve deflection wire proximal end and mounted for movement to the handle enabling selective extension and retraction of the curve deflection pull wire to induce a curve in the curvable proximal segment,

whereby selective adjustment of the knuckle bend and proximal curve manipulators induce bends in said bendable intermediate segment and curves in said proximal segment that are independent of one another.

2. The catheter of Claim 1, further comprising a first incompressible wire coil having a first incompressible wire coil lumen and extending from a first coil proximal end at the catheter body proximal end to a first coil distal end at the junction of the intermediate segment proximal end and the distal end of the proximal segment, a proximal section of said knuckle bend wire extending through said first incompressible wire coil lumen, whereby the first incompressible wire coil prevents inducement of a curve in the proximal segment and proximal section upon retraction of the knuckle bend wire within the first incompressible wire coil lumen by manipulation of the knuckle bend manipulator.

3. The catheter of Claim 2, further comprising a second incompressible wire having a second incompressible coil lumen coil and extending from a second coil proximal end at the catheter body proximal end to a second coil distal end at the junction of the proximal segment proximal end and the distal end of the proximal section, a proximal section of said curve deflection wire extending through said second incompressible coil lumen, whereby the second incompressible wire coil prevents inducement of a curve in the proximal section upon retraction of the curve deflection wire within the second incompressible coil lumen by manipulation of the proximal curve manipulator.

4. The catheter of Claim 3, wherein said first incompressible wire coil is contained floating within a first lumen of said catheter body enabling inducement of a bend in the intermediate segment by distal extension of the knuckle bend wire therethrough effecting an extension of the length of the catheter body without inducing an extension of the length of said first incompressible wire coil.

5. The catheter of Claim 4, wherein the first coil proximal end abuts a surface of a stop at the junction of the handle and the catheter body proximal end that the knuckle bend wire passes through that prevents proximal retraction of the first coil proximal end when the knuckle bend wire is retracted proximally through the first coil wire lumen and allows the first incompressible wire coil to move distally within the first lumen when the knuckle bend wire is extended distally through the first coil wire lumen.

6. The catheter of Claim 4, wherein the second incompressible wire coil is contained floating within a second lumen of said catheter body enabling inducement of a curvature in the proximal segment by distal extension of the curve deflection wire therethrough effecting an extension of the length of the catheter body without inducing an extension of the length of said second incompressible wire coil

7. The catheter of Claim 3, wherein the second incompressible wire coil is contained floating within a second lumen of said catheter body enabling inducement of a curvature in the proximal segment by distal extension of the curve deflection wire therethrough effecting an extension of the length of the catheter body without inducing an extension of the length of said second incompressible wire coil

8. The catheter of Claim 7, wherein the second coil proximal end abuts a surface of a stop at the junction of the handle and the catheter body proximal end that the curve deflection wire passes through that prevents proximal retraction of the second coil

proximal end when the curve deflection wire is retracted proximally through the second coil wire lumen and allows the second incompressible wire coil to move distally within the second lumen when the curve deflection wire is extended distally through the second coil wire lumen.

9. The catheter of Claim 7, wherein the second coil proximal end abuts a surface of a stop at the junction of the handle and the catheter body proximal end that the curve deflection wire passes through that prevents proximal retraction of the second coil proximal end when the curve deflection wire is retracted proximally through the second coil wire lumen and allows the second incompressible wire coil to move distally within the second lumen when the curve deflection wire is extended distally through the second coil wire lumen and when the knuckle bend wire is extended distally through the first coil wire lumen.

10. The catheter of Claim 2, wherein said first incompressible wire coil is contained floating within a first lumen of said catheter body enabling inducement of a bend in the intermediate segment by distal extension of the knuckle bend wire therethrough effecting an extension of the length of the catheter body without inducing an extension of the length of said first incompressible wire coil.

11. The catheter of Claim 1, wherein the knuckle bend wire is formed of a superelastic alloy that is resistant to kinking when retracted to form a bend in the bendable intermediate segment.

12. The catheter of Claim 1, wherein the knuckle bend wire and the curve deflection wire extend through the proximal section and the curvable proximal segment and the knuckle bend wire extends through the bendable intermediate segment in a common, off-axis, radius extending from the catheter body axis, whereby the bend induced in the bendable intermediate segment and the curve induced in the curvable proximal segment are in a common plane with respect to the catheter body axis.

13. The catheter of Claim 12, wherein the curve induced in the proximal segment is in the range of about -180° to about $+270^{\circ}$ with respect to the catheter body axis at the junction of the proximal section with the proximal segment.

14. The catheter of Claim 1, wherein the knuckle bend wire and the curve deflection wire extend through the proximal section and the curvable proximal segment and the knuckle bend wire extends through the bendable intermediate segment in a common, off-axis, radius extending from the catheter body axis, whereby the bend induced in the bendable intermediate segment upon retraction proximally of the knuckle bend wire and the curve induced in the curvable proximal segment upon retraction proximally of the curve deflection wire are in a common plane with respect to the catheter body axis and in a common direction.

15. The catheter of Claim 1, wherein the knuckle bend wire and the curve deflection wire extend through the proximal section and the curvable proximal segment and the knuckle bend wire extends through the bendable intermediate segment in a common, off-axis, radius extending from the catheter body axis, whereby the bend induced in the bendable intermediate segment upon extension distally of the knuckle bend wire and the curve induced in the curvable proximal segment upon retraction proximally of the curve deflection wire are in a common plane with respect to the catheter body axis but in differing directions.

16. The catheter of Claim 1, wherein the knuckle bend wire and the curve deflection wire extend through the proximal section and the curvable proximal segment and the knuckle bend wire extends through the bendable intermediate segment in a common, off-axis, radius extending from the catheter body axis, whereby the bend induced in the bendable intermediate segment upon retraction proximally of the knuckle bend wire and the curve induced in the curvable proximal segment upon extension distally of the curve deflection wire are in a common plane with respect to the catheter body axis but in differing directions.

17. The catheter of Claim 1, further comprising:
a third movable manipulator mounted to the handle; and
an axially rotatable lateral deflection wire coupling the proximal segment to the third movable manipulator so that selected movement of the third movable manipulator causes the lateral deflection wire to exert a lateral deflection force on said proximal segment causing the curve in said proximal segment to be deflected laterally.

18. A catheter suitable for use in applying ablation energy to body tissue or detecting electrical signals conducted within the body tissue comprising:

an elongated catheter body having a catheter body axis and extending between a catheter body proximal end and a catheter body distal end, the elongated catheter body having a catheter body proximal section extending distally from said catheter body proximal end and a deflectable distal tip section extending proximally from said catheter body distal end to a junction with said catheter body proximal section;

said deflectable distal tip section including a distal segment, a curvable proximal segment having a proximal segment length and a bendable intermediate segment having an intermediate segment length disposed between the distal segment and the curvable proximal segment;

at least one electrode positioned along the distal segment that is adapted to be disposed against body tissue for delivery of ablation energy thereto or for conduction of body tissue electrical signals;

a handle at the proximal end of the catheter body;

a conductor extending through the catheter body from the handle to the electrode;

and

an actuation mechanism extending through the catheter body to the deflectable tip section to selectively deflect the catheter body axis in the deflectable distal tip section with respect to the catheter body axis in the catheter body proximal section, the actuation mechanism adapted to curve the proximal segment in a first direction and to bend the intermediate segment in a second direction independently of the curve of the proximal segment to dispose the distal segment at a desired orientation to body tissue, wherein the actuation mechanism further comprises:

a first pull wire extending between a first pull wire proximal end disposed within said handle and a first pull wire distal end coupled to said distal segment;

a first pull wire lumen formed within said catheter body and extending between a first pull wire lumen proximal end communicating with said handle and a first pull wire lumen distal end, said first pull wire enclosed within said first pull wire lumen, said first pull wire lumen extending in parallel with said catheter body axis and displaced therefrom at a first off-axis location through said proximal and intermediate segments, and said first pull wire distal end affixed to said distal segment;

a first pull wire control formed in said handle coupled with said first pull wire proximal end enabling application and release of tension on said first pull wire, said first pull wire control having an extended position wherein said first pull wire is slack and a plurality of retracted positions wherein said first pull wire is retracted and tensioned thereby imparting a knuckle curvature through the intermediate segment length with respect to said proximal segment and deflecting the catheter body axis of said distal

segment with respect to the catheter body axis of the catheter body in the catheter body proximal section and the proximal segment;

a second pull wire extending between a second pull wire proximal end disposed within said handle and a second pull wire distal end coupled to the junction of said intermediate segment with said proximal segment;

a second pull wire lumen formed within said catheter body and extending between a second pull wire lumen proximal end communicating with said handle and a second pull wire lumen distal end, said second pull wire enclosed within said second pull wire lumen, said second pull wire lumen extending in parallel with said catheter body axis and displaced therefrom at a second off-axis location through said proximal segment, and said second pull wire distal end affixed to a junction of said proximal and intermediate segments, said first and second off-axis locations aligned with a common radial direction extending away from the catheter body axis;

a second pull wire control formed in said handle coupled with said second pull wire proximal end enabling application and release of tension on said second pull wire independently of application and release of tension on said first pull wire, said second pull wire control having an extended position wherein said second pull wire is slack and a plurality of retracted positions wherein said second pull wire is retracted and tensioned thereby imparting a curvature through the proximal segment length with respect to said distal segment and deflecting the catheter body axis of said proximal segment with respect to the catheter body axis of catheter body in the catheter body proximal section and the distal segment,

whereby independent manipulation of the first and second pull wire controls enables a knuckle curvature of the intermediate segment that deflects the distal segment in a first direction with respect to the proximal segment and formation of a curve in the proximal segment in a second direction sharing a common plane with respect to the catheter body axis in the catheter body proximal section and in the distal segment.

19. The catheter of Claim 18, further comprising:

a first incompressible wire coil having a first wire coil lumen and extending between a first coil proximal end and a first coil distal end and having a first coil lumen and first coil diameter, said first incompressible coil disposed within said first pull wire lumen with said first coil distal end disposed proximally to said intermediate tip section, and said first pull wire extending through said first incompressible coil lumen, whereby a distal portion of said first pull wire extends distally from said first coil distal end through said intermediate tip section; and

a second incompressible wire coil having a second wire coil lumen and extending between a second coil proximal end and a second coil distal end and having a second coil lumen and second coil diameter, said second incompressible coil disposed within said second pull wire lumen with said second coil distal end disposed proximally to said proximal tip section, and said second pull wire extending through said second incompressible coil lumen, whereby a distal portion of said second pull wire extends distally from said second coil distal end through said proximal tip section to a junction with said intermediate tip section.

20. The catheter of Claim 19, wherein the intermediate segment capable of bending in a knuckle bend having a radius of between about 2.0 mm and 7.0 mm through a range of about -90° to $+180^{\circ}$ with respect to the catheter body axis at the intermediate segment proximal end.

21. The catheter of Claim 19, wherein the curve induced in the proximal segment is in the range of about -180° to about $+270^{\circ}$ with respect to the catheter body axis at the junction of the proximal section with the proximal segment.

22. A catheter for mapping and/or ablation of heart tissue at a target site of a heart wall comprising:

a handle;

a catheter body attached at a catheter body proximal end to the handle, the catheter body having a catheter body axis extending through a proximal section and a distal section, the distal section comprising distal, proximal, and intermediate segments and a distal electrode in the distal segment, the catheter body adapted to be passed through a patient's vascular system such that the distal, proximal, and intermediate segments of the distal section of the catheter body are situated in proximity to heart tissue at the target site of the heart of the patient;

means operable from the handle outside the body and traversing the catheter body for selectively altering the angular orientation of the distal segment in relation to the catheter body axis in the proximal section to align the distal electrode with the surface of the heart tissue at the target site by selectively or collectively:

inducing a bend in the intermediate segment with respect to the proximal and distal segments having a radius of between about 2.0 mm and 7.0 mm through a range of about -90° to about $+180^\circ$ with respect to the catheter body axis; and

inducing a curve in the proximal segment with respect to the catheter body axis in the proximal section independently of the knuckle bend formed in the intermediate segment, the curve having a radius exceeding the radius of the knuckle bend through a range of between about -180° to about $+270^\circ$ with respect to the catheter body axis,

whereby the distal electrode is oriented and can be urged from the handle outside the body against the target site with force applied through the catheter body

23. A method for orienting an electrode of a catheter for mapping and/or ablation of heart tissue at a target site of a heart wall comprising the steps of:

providing the catheter for mapping and/or ablation of heart tissue comprising a handle and a catheter body attached at a catheter body proximal end to the handle, the catheter body having a catheter body axis extending through a proximal section and a distal section, the distal section comprising distal, proximal, and intermediate segments and a distal electrode in the distal segment;

passing the distal, proximal, and intermediate segments of the distal section of the catheter body in proximity to heart tissue at the target site of a heart of a patient;

from the handle outside the body, selectively altering the angular orientation of the distal segment in relation to the catheter body axis in the proximal section to align the distal electrode with the surface of the heart tissue at the target site by selectively or collectively:

inducing a bend in the intermediate segment with respect to the proximal and distal segments having a radius of between about 2.0 mm and 7.0 mm through a bending range of between about -90° to about $+180^{\circ}$ with respect to the catheter body axis; and

inducing a curve in the proximal segment with respect to the catheter body axis in the proximal section independently of the knuckle bend formed in the intermediate segment, the curve having a radius exceeding the radius of the knuckle bend through a range of between about -180° to about $+270^{\circ}$ with respect to the catheter body axis; and

from the handle outside the body, urging the distal electrode against the target site with force applied through the catheter body to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through said electrode.

24. A method for orienting an electrode of a catheter for mapping and/or ablation of heart tissue along the caval-tricuspid isthmus adjoining the inferior vena cava of the right atrium comprising the steps of:

providing the catheter for mapping and/or ablation of heart tissue comprising a handle and a catheter body attached at a catheter body proximal end to the handle, the catheter body having a catheter body axis extending through a proximal section and a distal section, the distal section comprising distal, proximal, and intermediate segments and a distal electrode in the distal segment;

passing the distal, proximal, and intermediate segments of the distal section of the catheter body through the vascular system and the inferior vena cava into proximity to heart tissue along the caval-tricuspid isthmus in the right atrium of a patient's heart;

from the handle outside the body, selectively altering the angular orientation of the distal segment in relation to the catheter body axis in the proximal section to align the distal electrode with the surface of the heart wall at the Eustachian ridge by selectively or collectively:

inducing a bend in the intermediate segment with respect to the proximal and distal segments having a radius of about 2.0 to about 7.0 mm and a bending angle in the range of about 0° to about 180° with respect to the catheter body axis; and

inducing a curve in the proximal segment with respect to the catheter body axis in the proximal section independently of the knuckle bend formed in the intermediate segment, the curve having a radius exceeding the radius of the knuckle bend and a curvature in the range of about -180° to about $+270^{\circ}$ with respect to the catheter body axis; and

from the handle outside the body, urging the distal electrode against the heart wall along the caval-tricuspid isthmus with traction applied through the catheter body to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through said electrode.

25. A method for orienting an electrode of a catheter for mapping and/or ablation of heart tissue adjoining the annulus of a pulmonary vein of the left atrium comprising the steps of:

providing the catheter for mapping and/or ablation of heart tissue comprising a handle and a catheter body attached at a catheter body proximal end to the handle, the catheter body having a catheter body axis extending through a proximal section and a distal section, the distal section comprising distal, proximal, and intermediate segments and a distal electrode in the distal segment;

passing the distal, proximal, and intermediate segments of the distal section of the catheter body through the vascular system and heart into proximity to heart tissue at the annulus of a pulmonary vein of the left atrium of a patient's heart;

from the handle outside the body, selectively altering the angular orientation of the distal segment in relation to the catheter body axis in the proximal section to align the distal electrode with the surface of the heart wall at the pulmonary vein annulus by selectively or collectively:

inducing a bend in the intermediate segment with respect to the proximal and distal segments having a radius of about 2.0 to 7.0 mm and a bending angle range of about 0° to about 120° with respect to the catheter body axis; and

inducing a curve in the proximal segment with respect to the catheter body axis in the proximal section independently of the knuckle bend formed in the intermediate segment, the curve having a radius exceeding the radius of the knuckle bend through a range of about -45° to about $+45^{\circ}$ with respect to the catheter body axis; and

from the handle outside the body, urging the distal electrode against the heart wall at the annulus of the pulmonary vein with traction applied through the catheter body to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through said electrode.

26. A method for orienting an electrode of a catheter for mapping and/or ablation of heart tissue adjoining the AV node of the right atrium comprising the steps of:

providing the catheter for mapping and/or ablation of heart tissue comprising a handle and a catheter body attached at a catheter body proximal end to the handle, the catheter body having a catheter body axis extending through a proximal section and a distal section, the distal section comprising distal, proximal, and intermediate segments and a distal electrode in the distal segment;

passing the distal, proximal, and intermediate segments of the distal section of the catheter body through the vascular system and heart into proximity to heart tissue at the AV node of the right atrium of a patient's heart;

from the handle outside the body, selectively altering the angular orientation of the distal segment in relation to the catheter body axis in the proximal section to align the distal electrode with the surface of the heart wall at the AV node by selectively or collectively:

inducing a bend in the intermediate segment with respect to the proximal and distal segments having a radius of between about 2.0 mm and 7.0 mm through a range of about -90° to about $+180^{\circ}$ with respect to the catheter body axis; and

inducing a curve in the proximal segment with respect to the catheter body axis in the proximal section independently of the knuckle bend formed in the intermediate segment, the curve having a radius exceeding the radius of the knuckle bend through a range of between about -180° to about $+270^{\circ}$ with respect to the catheter body axis; and

from the handle outside the body, urging the distal electrode against the heart wall at the AV node with traction applied through the catheter body to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through said electrode.

27. A method for orienting an electrode of a catheter for mapping and/or ablation of heart tissue under the cusps of the mitral valve within the left ventricle comprising the steps of:

providing the catheter for mapping and/or ablation of heart tissue comprising a handle and a catheter body attached at a catheter body proximal end to the handle, the catheter body having a catheter body axis extending through a proximal section and a distal section, the distal section comprising distal, proximal, and intermediate segments and a distal electrode in the distal segment;

passing the distal, proximal, and intermediate segments of the distal section of the catheter body through the vascular system and heart into proximity to cusps of the mitral valve in the left ventricle of a patient's heart;

from the handle outside the body, selectively altering the angular orientation of the distal segment in relation to the catheter body axis in the proximal section to align the distal electrode with the surface of the heart wall under the cusps of the mitral valve by selectively or collectively:

inducing a bend in the intermediate segment with respect to the proximal and distal segments having a radius of between about 2.0 mm and 7.0 mm through a range of about -90° to about $+180^{\circ}$ with respect to the catheter body axis; and

inducing a curve in the proximal segment with respect to the catheter body axis in the proximal section independently of the knuckle bend formed in the intermediate segment, the curve having a radius exceeding the radius of the knuckle bend through a range of between about -180° to about $+270^{\circ}$ with respect to the catheter body axis, and

from the handle outside the body, urging the distal electrode against the heart wall under the cusps of the mitral valve with traction applied through the catheter body to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through said electrode.

28. A method for orienting an electrode of a catheter for mapping and/or ablation of heart tissue along the caval-tricuspid isthmus anterior to the inferior vena cava of the right atrium comprising the steps of:

providing the catheter for mapping and/or ablation of heart tissue comprising a handle and a catheter body attached at a catheter body proximal end to the handle, the catheter body having a catheter body axis extending through a proximal section and a distal section, the distal section comprising distal and intermediate segments and at least one distal electrode in the distal segment coupled by a conductor extending through the catheter body to the handle, said distal segment including an elongated, elastic electrode support body having at least one electrode extending along the length of the electrode support body and adapted to conform to surface contours of the heart wall along the caval-tricuspid isthmus that the elastic electrode support body is applied against by formation of a knuckle bend in said intermediate segment;

passing the distal section of the catheter body through the vascular system and the inferior vena cava to locate the distal section in proximity to heart tissue at the caval-tricuspid isthmus in the right atrium of a patient's heart;

from the handle outside the body, selectively altering the angular orientation of the distal segment in relation to the catheter body axis in the proximal section to align the distal electrode with the surface of the heart wall at the Caval-tricuspid isthmus by inducing a bend in the intermediate segment; and

from the handle outside the body, hooking the intermediate segment over the Eustachian ridge to orient the elongated, flexible electrode support body against and in conformance with contours of the heart wall between the Eustachian ridge and the tricuspid valve cusps to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through said electrode.

29. The method of Claim 28, wherein the selectively altering step further comprises:

forming a bend in said intermediate segment having a radius of about 2.0 to about 7.0 mm and a bending angle range of about 0° to about 180° with respect to the catheter body axis.

30. The method of Claim 28, wherein

the step of providing the catheter for mapping and/or ablation of heart tissue comprises providing the distal section comprising a proximal segment between the intermediate segment and the proximal section; and

the selectively altering step further comprises inducing a curve in the proximal segment with respect to the catheter body axis in the proximal section independently of the knuckle bend formed in the intermediate segment, the curve having a radius exceeding the radius of the knuckle bend through a range of about -45° to about +45° with respect to the catheter body axis.

31. The method of Claim 28, wherein the catheter providing step further comprises providing a plurality of spaced apart, ring-shaped electrodes along said elongated, flexible electrode support body to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through selected pairs of said electrodes.

32. The method of Claim 28, wherein the catheter providing step further comprises providing at least one spiral electrode wound around and along said elongated, flexible electrode support body to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through selected said electrode.

33. A catheter for ablation and/or mapping of the heart wall comprising:
an elongated catheter body having proximal and distal ends and a catheter body axis, the catheter body further comprising a catheter body proximal section joined at a proximal section distal end with a deflectable catheter body distal section;
said distal section including a distal segment and a bendable intermediate segment having a predetermined intermediate segment length, the intermediate segment capable of bending in a knuckle bend;
said distal segment including an elongated, elastic electrode support body having a at least one electrode extending along the length of the electrode support body and adapted to conform to surface contours of the heart wall that the elastic electrode support body is applied against by formation of a knuckle bend in said intermediate segment;
a handle at the proximal end of the catheter body;
a conductor extending along the catheter body between said electrode and the handle;
a knuckle bend wire coupled to the distal segment and extending proximally through the bendable intermediate segment, the proximal segment, and the proximal section of the catheter body to a knuckle bend wire proximal end in the handle;
a knuckle bend manipulator coupled to the knuckle bend wire proximal end and mounted for movement to the handle enabling selective extension and retraction of the knuckle bend wire to induce a bend in the bendable intermediate segment; and
whereby selective adjustment of the knuckle bend manipulator induces a bend in said bendable intermediate segment that enables the orientation of the elongated, flexible electrode support body against the heart wall to conform to surface contours of the heart wall.

34. The catheter of Claim 33, wherein the selective adjustment of the knuckle bend manipulator induces a bend in said bendable intermediate segment having a radius of about 2.0 to about 7.0 mm and a bending angle range of about 0° to about 180° with respect to the catheter body axis.

35. The catheter of Claim 34, wherein said distal section includes a proximal segment, and said bendable intermediate segment is joined at an intermediate segment proximal end with a proximal segment distal end and joined at an intermediate segment distal end with the distal segment, and further comprising:

a curve deflection wire coupled to the distal end of the proximal segment and extending proximally through the proximal segment and the proximal section of the catheter body to a curve deflection wire proximal end in the handle; and

a proximal curve manipulator coupled to the curve deflection wire proximal end and mounted for movement to the handle enabling selective extension and retraction of the curve deflection pull wire to induce a curve in the curvable proximal segment.

36. The catheter of Claim 33, wherein said distal section includes a proximal segment, and said bendable intermediate segment is joined at an intermediate segment proximal end with a proximal segment distal end and joined at an intermediate segment distal end with the distal segment, and further comprising:

a curve deflection wire coupled to the distal end of the proximal segment and extending proximally through the proximal segment and the proximal section of the catheter body to a curve deflection wire proximal end in the handle; and

a proximal curve manipulator coupled to the curve deflection wire proximal end and mounted for movement to the handle enabling selective extension and retraction of the curve deflection pull wire to induce a curve in the curvable proximal segment.

37. The catheter of Claim 33, further comprising a plurality of spaced apart, ring-shaped electrodes formed along said elongated, flexible electrode support body to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through selected pairs of said electrodes, each electrode coupled to a conductor extending proximally through the catheter body to said handle.

38. The catheter of Claim 33, further comprising at least one spiral electrode wound around and along said elongated, flexible electrode support body to enable mapping of cardiac signals within and delivery of ablation energy to the adjoining heart wall through selected said electrode.

Add A2